5. Problems from the Textbook: 1, 4, 5, 10, 11, 18-20, 24, 25, 31, 35, 36 (1.4); 1-3, 8, 12-14, 18, 21, 24, 29, 31, 33, 38, 49, 52, 57, 59 (1.5); 1-5, 8, 11, 14, 15, 18 (1.6); 1, 3, 5, 7, 9, 11, 19, 31, 34, 37, 41, 49, 51, 53 (2.1).

6. Throughout this problem we use the functions defined in Problem 3.

   (a) Where is q continuous?

   (b) Where is h continuous?

   (c) Where is r continuous?

   (d) Find $a, b \in \mathbb{R}$ such that $F(x) = \begin{cases} f(x) & \text{for } x < a \\ b & \text{for } x = a \\ g(x) & \text{for } x > a \end{cases}$ is continuous on $\mathbb{R}$.

   (e) Find $a, b \in \mathbb{R}$ such that $G(x) = \begin{cases} q(x) & \text{for } a \le x \le b \\ h(x) & \text{otherwise} \end{cases}$ is continuous on $\mathbb{R}$.

   (f) Sketch the function G from (e).

7. Determine constants $a, b \in \mathbb{R}$ such that the following functions are continuous on $\mathbb{R}$.

   (a) $f(x) = \begin{cases} ax + 2 & \text{for } x < 1 \\ 6 & \text{for } x = 1 \\ x^2 + bx + 5 & \text{for } x > 1 \end{cases}$.

   (b) $f(x) = \begin{cases} bx + 2 & \text{for } x \le -5 \\ \frac{ax^2 - 3}{x+5} & \text{for } x > -5 \end{cases}$.

8. Find all zeros of the function $f(x) = x^3 - 2x^2 - 19x + 20$.

9. Let $f(x) = x^3 - x^2 - 1$.

   (a) Show that f has a zero α with $1 < \alpha < 2$.

   (b) Use the bisection method to find an interval (a, b) with $|b - a| < 0.01$ such that f has a zero $\alpha \in (a, b)$.

10. Let $f(x) = \frac{x^2 - 6x + \frac{17}{2}}{x - 1}$.

    (a) Show that f has a zero α with $2 < \alpha < 3$.

    (b) Apply the bisection method for three times to find a better approximation of α.

    (c) Is there a zero of f between 0 and 2?

11. Use the definition of the derivative to do the following (notation see Problem 3).

    (a) Find $f'(x)$.

    (b) Find $q'(x)$.

    (c) Find $(f \cdot g)'(x)$.

    (d) Find $(f \circ g)'(x)$.

    (e) Find $\tilde{h}'(4)$.

    (f) Find $r'(1)$.

12. Find the equation of the tangent at q (see Problem 3) through the point $(1, 3)$.